1996 Hemp Evaluation Trials

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Introduction

Interest continues to build for this crop. As of this report, federal regulations still prohibit any cultivation of hemp (*Cannabis sativa L.*) except under permit for research purposes. Following after the initiation of studies in 1995, hemp evaluations were conducted at six locations in Manitoba in 1996. Five of these were under research permits held by the New Crop Development staff of Manitoba Agriculture.

Results for one of those sites (SW Manitoba) are reported here, while results for the project as a whole will be reported elsewhere. Funds to purchase seed and conduct various analyses was gratefully received from the Sustainable Development Innovations Fund.

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Objective:

- Evaluate low - THC industrial hemp varieties for fibre and seed production in Manitoba.
- Estimate the economic feasibility of hemp production in Manitoba, for fibre and for seed.

Methods:

Location: Southwestern Manitoba

Expt. Design: Randomized complete block with 3 replications for fibre and seed trials; plot size 1.83 m x 7 m.

Seeding Date: June 11

Seeding Rate: Fibre block 500 seeds/sq.m.; seed, herbicide, fertilizes blocks 100 seeds/sq.m.

Seeding Method: 9-row plot planter, 8 inch spacing.

Fertility: Soil test after fertilizing and seeding.

	N	P_2O_5	K_2O	S	
Available	161	64	1058	31	lb/acre

	0-6 in.	6-12 in.
pH	7.2	7.7

Herbicides: Some spot treatment of Canada thistle with glyphosate.

Harvest: For stalk yield, hemp was swathed manually at early flowering bundle when field dry. For seed yield, stalks were threshed using Hege combined.

Results:

Variety Evaluation

Fibre Trial

The first five varieties listed below were similar in flowering date and were cut for evaluation on August 7 (57 days after sowing). The next four varieties were later to flower and were all cut on August 15 (65 days after sowing). In general, the later flowering varieties were taller and yielded considerably higher, since they had an extra eight days of growth. If high quality fibre production is the objective, clearly the late varieties are preferred from a productivity perspective. However, the issue of relative fibre quality among these varieties has yet to be explored, and analyses are pending in cooperation with the Department of Clothing and Textiles of the University of Manitoba. These varieties did not differ significantly in stand count, with an average 30% of the seeds resulting in a harvestable plant (500 seeds/sq.m. --> 149 plants/sq.m. at harvest). Further trials are necessary to determine optimum seeding rate for fibre production in Manitoba. All varieties were sampled at early flowering to determine D^9 - THC content; all tested below the maximum allowable level of 0.30%, except Uniko B which tested at 0.30%.

Table 1 - Agronomic characteristics and D^9 - THC content for hemp cultivars grown at fibre density (500 seeds/sq.m.) - 1996 SW Manitoba.

Cultivar	Stand (plants/m^2)	Height (m)	Stalk Yield		D^9 - THC (%)
			(kg/ha)	(16/acre)	
Zolotonosha 11	158	2.11 cH	7860 bc	7020 bc	<0.05
Zolotonosha 13	145	2.12 bc	7920 bc	7070 bc	<0.05
Polish 1	142	2.07 c	8150 bc	7280 bc	0.13
Polish 2	114	2.07 c	7260 c	6480 c	0.17
Fedora 19	164	2.08 c	8440 b	7530 b	0.10
Felina 34	185	2.19 b	10710 a	9560 a	0.06
Uniko B	119	2.35 a	10520 a	9390 a	0.30
Kompolti	139	2.33 a	10450 a	9330 a	0.21
Future 77	172	2.31a	11160 a	9960 a	0.15
LSD (0.05)	NS	0.08	1070	960	
Average	149	2.18	9160	8180	
CV (%)	21.5	2.6	7.2	7.2	

*Values within a column are significantly different if not followed by the same letter.

Seed Trial

Low key market and economic feasibility studies suggest that growing hemp as an oilseed crop may have the most potential for Manitoba. Therefore, we conducted a variety trial aimed specifically at evaluating several varieties for their seed production. Note that these varieties have been bred as fibre producers and are not particularly prolific seed producers. However, varieties bred as seed producers are not readily available. To promote branching, flowering and seed set on these fibre type varieties, the plots were sown at a much lower density - 100 seeds/sq.m. The stands were acceptable but variable, and the average stand by harvest time was only about 32% of the seeds sown. Considering the late sowing, seed yields were excellent, with the French varieties Fedora 19 and Felina 34 exhibiting by far the highest yields. Small plot yields tend to overestimate yield potential on a field-scale - yields of Zolotonosha 11 and 13 on field scale in Manitoba yielded approximately half of the yields in this small plot trial. D^9 - THC samples taken in approximately mid-flowering tested well below the 0.3% maximum allowed under the terms of the research licenses. Analyses of seed and oil quality are pending and will be reported separately. Last year's analyses showed our hemp seed to have a favorable fatty acid profile and level of antioxidants.

Table 2 - Agronomic characteristics and D^9 - THC content for hemp cultivars grown at seed density (100 seeds/sq. in.) - 1996 SW Manitoba.

Cultivar	Stand ($plants/m^2$)	Seed Yield		D^9 - THC (%)
		(kg/ha)	(16 /acre)	
Zolotonosha 11	30	930 bcH	830 bc	<0.05
Zolotonosha 13	34	885 bc	790 bc	<0.05
Polish 1	32	820 c	732 c	0.05
Polish 2	28	691 c	617 c	0.11
Fedora 19	29	1567 a	1399 a	0.12
Felina 34	37	1228 ab	1096 ab	0.08
LSD (0.05)	NS	355	317	
Average	32	1020	911	
CV (%)	24.5	20.4	20.4	

* Values within a column are significantly different if not followed by the same letter.

Herbicides and Hemp

Although many claims are made that hemp's competitive ability makes herbicides completely unnecessary, there will be instances in which growers will find need for herbicides in weed management. We undertook an initial unreplicated screening to identify herbicides that might have potential from the perspective of crop safety - efficacy was not evaluated. The preemergent treatments of trifluralin, metribuzin, and metolachlor did not appear to injure the hemp crop. Of the post emergence treatments screened, only chlopyralid did not cause major injury to the crop - all other treatments were severely injurious or lethal. This trial was terminated at early flowering, so subtle injury symptoms such as delayed maturity and yield were not observed. Further study is required, in terms of both screening more herbicides, and more detailed observation of those that appeared promising. Also, before any herbicides could be recommended for use in hemp, the appropriate product registrations would have to be secured.

Table 3 - Effects of selected herbicides on hemp crop growth and development - 1996 SW Manitoba, unreplicated observational study.

Herbicide	Comments
trifluralin, preplanting incorporated	no apparent damage
metribuzin, preplanting	no apparent damage
metolachlor, preplanting incorporated	no apparent damage
EPTC, preplanting incorporated	no apparent damage
metribuzin, postemerge	leaf tips burned, growth halted
imazethepyr, postemerge	some burning, chlorotic/necrotic growing points, some stem and leaf epinasty
bromoxymil/MCPA	epinasty of stems severe, leaf tips chlorotic/necrotic, some plants dead
chlopyralid, postemerge	chlorotic growing points on 25% of plants, otherwise OK
ethametsulfuron-methyl, postemerge	stunted, growing points chlorotic/necrotic, a little stem twisting
bentazon, postemerge	all leaves completely burned and dead, a few escapes
MCPA ester, postemerge	no chlorosis, severe epinasty

Seed-Placed Fertilizers and Hemp

An unreplicated trial was conducted to provide an initial indication of how tolerant hemp might be to seed-placed fertilizers. Stand reductions were evident when seed-placed N or P_2O_5 exceeded 20 lb/acre, suggesting that hemp is moderately sensitive to seed-placed fertilizers. Further detailed study is required to verify this initial observation.

Table 4 - Effect of seed-placed fertilizers on hemp crop stand - 1996 SW Manitoba unreplicated observational study.

Seed-placed fertilizer	Rate	Stand (plants sq.m.)
34-0-0	0	44
34-0-0	20 lb N/acre	51
34-0-0	40 lb N/acre	11
11-52-0	0	37
11-52-0	20 lb P_2O_5/acre	43
11-52-0	40 lb P_2O_5/acre	23
16-20-0	0	26
16-20-0	20 lb P_2O_5; 16 lb N/acre	41
16-20-0	40 lb P_2O_5; 32 lb N/acre	12

Insect Survey in Hemp Site

Lynn Manaigre, Extension Entomologist, Soils and Crops Branch

An insect survey was conducted on August 7, 1996 at the hemp site. The survey was conducted using a sweep net. The insects collected were as follows:

- 1 two-striped grasshopper
- 1 migratory grasshopper
- 1 nymphal grasshopper
- 9+ lygus bugs
- 1 wheat midge
- 4 *Gastrophysa polygoni* (flower/foliage feeder in the leaf beetle family; main hosts are knotweed and wild buckwheat)
- 1 stink bug
- 6 syrphid flies
- <100 aphids

3 types of damage were noted:

- shot holes in leaves (could be either flea beetles or grasshoppers).
- even patterned holes on both sides of leaf (likely bertha armyworm- this sample was collected during the day; therefore, bertha armyworm larvae would likely be resting under leaf litter).
- leaf damage from the outer edge (likely grasshoppers).

These results suggest that the insect pests of hemp included bertha armyworm and grasshoppers. Other insect pests which are likely candidates for pest status include flea beetles (early season), lygus bugs (at flowering) and possibly aphids. Aphid numbers were high in 1996.

In 1997, I would recommend sampling early and mid-season, and I would recommend relating plant development stage to the insects found in the sample. Since most plants are more susceptible to certain insects at certain developmental stages, this would give us an idea of this relationship.

Pollinators Associated with Hemp

Rhéal Lafrenière, Extension Apiarist, Soils and Crops Branch

The following are some of the insects we observed foraging for pollen in the hemp plots. This list was produced from our limited (.1.5 hr.) observations in the field during the early blooming period of the crop. By

no means is this list complete, but rather a simple list of some of the insects that may contribute to the pollination of the hemp. Although some of the insects observed were in direct contact with hemp pollen, the question that remains to be answered, is whether these same insects will also visit the female parts (or flowers) of the hemp plant.

- Honey bees were observed foraging for pollen in the hemp plot, even though there appeared to be no honey bee colonies within the immediate area (i.e. $2km_2$). Honey bees were by far the most abundant, (frequently observed) pollen foragers in the plots during our field observation. Hemp pollen was collected from the hemp flowers and compared to the pollen collected from the honey bees to verify that the pollen collected by the honey bees was indeed hemp. **And it was!**
- Bumble bees were observed in the vicinity of the hemp plots, but no active foraging behaviour was recorded during our observations. Although no bumble fee foraging was observed in the sites, I did observe bumble bees gather pollen in a hemp field in the NW part of the province. A sample of pollen was collected from the bumble bee and tested for hemp content. **It came back positive!**
- Hover flies among several other dipteran insects (ie. flies) were observed in the hemp fields, but their contribution to the pollination of the crop is likely to be minimal.
- Lygus bugs were found on several occasions in the male hemp flowers, but it is unlikely that they would contribute much to the transfer of pollen to the female flowers.